CLAIMS

What is claimed is:

1. A method for reducing volume resistivity of a body consisting essentially of aluminum nitride, comprising exposing the body to a temperature of at least about 1000°C in an atmosphere deficient in nitrogen.

2. The method of Claim 1, wherein said body is polycrystalline.

3. The method of Claim 2, wherein the partial pressure of nitrogen in said atmosphere is less than about 35 kPa.

4. The method of Claim 3, wherein said atmosphere consists essentially of a gas selected from the group consisting of argon, helium, and mixtures thereof.

5. The method of Claim 4, wherein said atmosphere consists essentially of argon.

6. The method of Claim 5, wherein the body is exposed to a temperature of at least about 1200°C.

7. The method of Claim 6, wherein the body is exposed to a temperature of at least about 1500°C.

8. The method of Claim 7, wherein the body is exposed to a temperature of at least about 1650°C.

9. The method of Claim 4, wherein the body is exposed to said temperature for a period of at least about 0.5 hours after the body has reached thermal equilibrium.

10. The method of Claim 9, wherein the body is exposed to said temperature for a period of at least about four hours after the body has reached thermal equilibrium.

11. The method of Claim 8, further including the steps of cooling the body at a rate of less than about 15°C per minute to a temperature of less than about 1200°C.

12. The method of Claim 11, wherein the body is cooled to a temperature of about 1500°C.

13. The method of Claim 1, wherein the atmosphere is at a pressure of at least about 1 Pa.

14. The method of Claim 1, wherein the atmosphere is at a pressure of between about 7 kPa and about 14 kPa.

15. The method of Claim 4, wherein the polycrystalline body is exposed to said atmosphere at a temperature of at least about 1650°C for a period of at least about four hours, and wherein the atmosphere is at a pressure of about 20 MPa.

16. The method of Claim 15, further including the step of cooling the polycrystalline body to a temperature of about 1500°C at a rate of about 15°C per minute.

17. The method of Claim 16, wherein the polycrystalline body has a relative density greater than about 98% of its theoretical density.

18. The method of Claim 1, wherein said body is a green body.

19. The method of Claim 18, wherein the green body includes aluminum nitride particles having an average particle size in a range of between about 0.1μm and

about 5.0μm.

20. The method of Claim 19, further including the step of sintering said green body.

21. The method of Claim 20 wherein said green body is sintered at a temperature of at least about 1600°C.

22. The method of Claim 21, wherein said green body is sintered in an atmosphere deficient in nitrogen.

23. The method of Claim 22, wherein said atmosphere consists essentially of argon.

24. The method of Claim 23, wherein sintering said green body causes said body to become polycrystalline.

25. The method of Claim 24, further including the step of cooling said polycrystalline body to about 25°C prior to exposing the body to a temperature of at least about 1000°C in an atmosphere deficient in nitrogen.

26. The method of Claim 25, wherein the polycrystalline body is exposed to a temperature of at least about 1600°C for a period of at least about four hours.

27. The method of Claim 26, further including the step of cooling the polycrystalline body to a temperature less than about 1500°C at a rate less than about 15°C per minute.

28. The method of Claim 27, wherein the polycrystalline body has a relative density greater than about 98% of its theoretical density.

29. The method of Claim 20, wherein the green body is sintered at a pressure in a

range of between about 10 MPa and about 50 MPa.

30. The method of Claim 20, wherein the green body is sintered at a pressure of at least about 10 MPa.

31. The method of Claim 30, wherein the green body is sintered at a pressure of about 20 MPa.

32. The method of Claim 1, wherein the body is exposed to said temperature in excess of about 1000°C for a period of time sufficient to cause the volume resistivity to be in a range of between about $1x10^{8}$ ohm·cm and about $1x10^{13}$ ohm·cm at a temperature of about 23°C.

33. The method of Claim 1 wherein the body is formed form an AlN powder and said powder is exposed to a temperature of at least about 1000°C in an atmosphere deficient in nitrogen.

34. A method for forming a polycrystalline aluminum nitride body having a volume resistivity less than about $1x10^{13}$ ohm·cm at a temperature of about 23°C, comprising the steps of:

a) sintering a green body consisting essentially of aluminum nitride to form a polycrystalline body; and

b) exposing said polycrystalline body to a soak temperature of at least about 1000°C in an atmosphere deficient in nitrogen for a period of time sufficient to cause the volume resistivity of the polycrystalline body to be less than about $1x10^{13}$ ohm·cm at a temperature of about 23°C.

35. The method of Claim 34 wherein the atmosphere deficient in nitrogen consists essentially of argon.

36. The method of Claim 35, wherein the green body includes aluminum nitride powder having an average particle size in a range of between about 0.1μm and about 5.0μm.

37. The method of Claim 36, wherein the polycrystalline body is cooled from a sintering temperature to at a rate less than about 15°C per minute.

38. The method of Claim 37, wherein the green body is sintered in a nitrogen-deficient atmosphere.

39. The method of Claim 38, wherein the green body is sintered in an atmosphere consisting essentially of argon.

40. The method of Claim 39, wherein the green body is sintered at a pressure in a range of between about 10 MPa and about 50 MPa.

41. The method of Claim 39, wherein the green body is sintered at a pressure of at least about 10 Mpa.

42. The method of Claim 34 wherein the green body is formed from an AlN powder exposed to a soak temperature of at least about 1000°C in an atmosphere deficient in nitrogen.

43. A method of reducing the volume resistivity of an electrostatic chuck consisting essentially of aluminum nitride, comprising exposing at least a portion of the electrostatic chuck to a temperature of at least about 1000°C in an atmosphere deficient in nitrogen.

44. The method of Claim 43, wherein the atmosphere consists essentially of argon.

45. The method of Claim 43, wherein the electrostatic chuck is exposed to said temperature in excess of 1000°C for a period of time sufficient to cause the volume resistivity of the chuck to be in a range of between about $1x10^{8}$ ohm·cm and about $1x10^{13}$ ohm·cm at a temperature of about 23°C.

46. An electrostatic chuck, comprising:

a) an electrode having a first side and a second side; and

b) a body consisting essentially of aluminum nitride, said body having a first portion at the first side of said electrode and a second portion at the second side of the electrode, said first portion of the body having a volume resistivity less than about $1x10^{13}$ ohm·cm at about 23°C, and wherein the volume resistivity of the second portion is within one order of magnitude that of the first portion.